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REGIONAL INDUSTRIAL MULTIPLIER SYSTEM

RIMS

a guide for River Basin Analysts

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ABSTRACT

This report explains, in simplified terms, the Regional Industrial Multiplier System (RIMS) and its potential usefulness to the river basin planner. Industry-specific multipliers can be calculated for a given river basin and used by the planner to estimate the impact of proposed projects and programs on the regional economy. Initial changes in regional output can be translated into changes in both employment and income.

KEY WORDS

Regional multipliers, impact analysis, forest economics, river basins, area planning.

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ACKNOWLEDGEMENTS

The author wishes to express her gratitude to Henry Hammond, U. S. Forest Service, who conceived of this project and provided assistance throughout and Dr. Raymond Ferell, Western Carolina University, for his valuable suggestions.

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THE REGIONAL INDUSTRIAL MULTIPLIER SYSTEM: A GUIDE FOR RIVER BASIN ANALYSTS

by

Ellen Hall*

I. Introduction

The publication in 1973 of the *Principles and Standards for Water and Related Land Resource Planning* signaled a new attitude toward planning the use of the Nation's resources. It was the intent of the Water Resource Council in writing the *Principles and Standards* to provide not only a broad framework for planning activities, but also a uniformity and consistency in comparing, measuring and evaluating the beneficial and adverse effects of alternative plans. The *Principles and Standards* planning framework is based on the mutual national objectives of National Economic Development and Environmental Quality. The ability of alternative plans to contribute to the national objectives is evaluated using four accounts: National Economic Development, Environmental Quality, Regional Development and Social Well Being. Although the *Principles and Standards* do not specify the techniques to be used in making plan evaluations, they do require that benefits and costs be measured in quantitative terms whenever possible and that both direct and indirect effects be considered.

The Bureau of Economic Analysis (BEA), U.S. Department of Commerce, has developed a procedure, termed the Regional Industrial Multiplier System (RIMS), which may be used in evaluating projects for the Regional Development account. Regional Development (RD) as defined by *Principles and Standards* includes regional income, regional employment and regional economic stability. RIMS is essentially a technique for estimating regional output multipliers which can be used to measure project or program impacts on output. Changes in income and employment in the region can be estimated from this output base.

This report is offered as a user's guide to RIMS. Included is a brief description of the system's functions, its applicability to river basin planning and the system's advantages and disadvantages. The appendix includes sample tables, supporting information, and two complete example problems.

The examples used throughout are drawn from the Chowan-Pasquotank River Basin Study Area, a 29-county area in eastern North Carolina and Virginia.

II. The Regional Industrial Multiplier System

RIMS was developed for estimating the regional economic impact of projects or programs which directly affect only a limited number of industries. As such, river basin planners can use RIMS to estimate the impact of alternate river basin plans and thereby fulfill the requirements of *Principles and Standards*. The system enables the

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basin planner to estimate the total change in gross regional output associated with a change in final demand for any impacted industry. For example, an increase in the demand for furniture will affect the output not only of the furniture industry, the impacted industry, but also the output of those firms which supply the furniture industry with materials, labor, electricity and so forth. These firms also increase their purchases, setting off additional rounds of output increases. Similarly, an increase in the demand for forest products will affect more than just timber growers. The total regional impact will be some multiple of the original change. Because the multiple will be different for each industry within a region or for the same industry in different regions, it is valuable to calculate multipliers that are specific to a given industry in a given region. It is these multipliers which RIMS can supply, for 478 different industries and in any county or region made up of counties.

Economists frequently tackle impact analysis by constructing an Input-Output (I-O) model designed to show economic interactions in the region (3,4). The construction of an input-output table is a very time-consuming task, requiring industry surveys or lengthy review of secondary data sources. For that reason, RIMS was developed as a short cut that would permit more timely and less expensive analysis. Although RIMS relieves the analyst of the need to construct a conventional I-O model, an understanding of I-O is useful in understanding how and why RIMS was designed.

An input-output table is composed of three parts: a processing sector, a final demand sector and a payments sector. The processing sector is divided into industries and displayed as a matrix: each industry is represented by a column showing the purchases of that industry and a row showing its sales to others. Each element in the matrix shows the sales of the producing (row) industry to the purchasing (column) industry. For example, one element in the matrix might represent sales of local agriculture to the local food processing industry. The model is constructed for a specific geographic region (e.g., the whole Nation, a State or a river basin) and a specific time period (1 year) and only those transactions taking place wholly within the area are included in the processing sector.

To the processing sector are then added several rows for the payments sector (which includes imports, payments to governments, depreciation allowances and payments to households) and several columns for the final demand sector (which includes government purchases, exports from the region and purchases of goods and services by households).

Figure 1 shows the simplified structure of the completed input-output table. At this point all the transactions which affect the regional economy have been included. 1/

It is important to remember that the final demand sector is the only autonomous sector in the economy and any change in production in the processing sector is a response to a change in demand.

1/ The fourth quadrant of the table, where the payments sector and the final demand sector intersect, is frequently omitted.

		Processing Sector	Final Demand Sector
		Purchasing Industry A B C D	Households Exports . . . .
Processing Sector	Producing Industry A B C D . .	Intermediate transactions: goods and services both produced and used within the region during the production process.	Ultimate purchases from the producing sector by the final consuming entities in the economy.
Payments Sector	Imports Households . .	Primary inputs to the producing sector.	

Figure 1 - Simplified Structure of an Input-Output Table

III. Calculation of RIMS Multipliers

After the input-output table has been constructed, a matrix of technical coefficients is developed from the processing sector. Each technical coefficient indicates the amount of inputs required from the row industry to produce one dollar's worth of output by the purchasing (column) industry. For a given industry, therefore, the entire column of technical coefficients indicates the amount of inputs required from all other industries in the region to produce one dollar's worth of output from the given industry. The technical coefficients then provide the basis to calculate a multiplier for that industry. RIMS eliminates the need to construct a regional I-O table by calculating these regional, industry-specific multipliers in another, less expensive, less time-consuming way.

The RIMS procedure for calculating industry-specific multipliers begins with the most recent BEA national Input-Output table. Starting with the assumption that the regional economy will be similar, but not identical, to the national economy, several steps are taken to "regionalize" the national I-O table (2,5,7). First, for a given industry, the column of technical coefficients is lifted from the national I-O table. Next, the technical coefficients for industries not present in the region of interest are removed from the column. In the Chowan-Pasquotank River Basin, for example, there are no Paperboard Mills and the technical coefficients for that industry would be removed from all columns in which they appear. In the Chowan-Pasquotank this means that the Paperboard Container and Box Industry imports its paperboard and expansion of the industry will have less impact on the regional economy than it will on the national economy.

The third step in the regionalization of the technical coefficients involves the use of location quotients. For each industry, the location quotient indicates whether the industry is more or less concentrated in the region than it is in the Nation. RIMS uses BEA county earnings data to calculate each location quotient as follows:

$$L_i = \frac{\%\text{ of total regional earnings earned in industry } i}{\%\text{ of total national earnings earned in industry } i}$$

We can assume that if every region in the nation were self-sufficient and its economy had the same structure as the nation's, then it would have the same percentage of earnings from each industry as the Nation. Thus, a location quotient greater than one indicates that the region is more than self-sufficient in that industry (i.e., is a net exporter of the industry's product) and a location quotient less than one indicates the region is a net importer of that industry's product.

The RIMS procedure uses the location quotient for each industry to make necessary adjustments in the technical coefficients. If the location quotient for a given industry is greater than or equal to one, it is assumed that any input required by the regional economy from that industry is available within the region and the corresponding technical coefficient is left unaltered. If the location quotient is less than one, we assume the industry does not meet the total regional demand for its product. Because the location quotient represents the fraction of inputs available within the region, the corresponding technical coefficient is reduced by multiplying it by the location quotient.

At this point, the industry's household coefficient (representing earnings of households resulting from one dollar's worth of production of the industry's output) is moved from the Payments sector into the coefficient column and the entire column of technical coefficients is summed, giving what is called the direct component of the

industry multiplier. The direct component now indicates the value of inputs required directly from local industries and households needed to produce one dollar's worth of output from the producing industry. Another component, the direct-induced component, is then derived from the direct component, taking into consideration the economic size of the region and its industrial structure. The indirect-induced component indicates the change in regional economic activity resulting from the change in the activity of the input industries and the change in the purchasing power of households. The industry multiplier is equal to one plus the direct (D) and the indirect-induced (I) components:

$$M = 1 + D + I$$

The result of the procedure is a series of tables, one for each sector or industry. 2/ Figures 2 and 3 are examples of the tables supplied by RIMS. Each lists the input industries and corresponding technical, or direct requirement, coefficient, the direct component, the indirect-induced component and the multiplier. Figure 2 indicates that the Forestry and Fishery Products Sector buys 10.35 percent of its inputs from Farms, 2.3 percent from Agricultural Services, 1.75 percent from itself, and so on. The direct component is equal to the sum of the direct requirement coefficients and indicates that purchases from other sectors in the region account for only 28.1 percent of the inputs to the Forestry and Fishery Products Sector in the Chowan-Pasquotank River Basins. The multiplier is a rather low 1.556 (1 + .281 + .275). In contrast, figure 3 indicates that Logging Camps and Contractors buy 73.3 percent of their inputs from other sectors in the region. The multiplier of 2.472 (1.0 + .733 + .739) is correspondingly higher and indicates that increased activity in the logging sector would have a greater impact on the regional economy than increased activity in the forest products sector.3/

IV. Applications of the RIMS Multipliers

Once initial impacts of a project or planning alternative have been estimated, total regional impacts can be estimated by the use of the multipliers.

Backward Linkage Effects 4/

The simplest approach to estimating program impacts is to follow the backward linkages, i.e., to trace the economic impact of a change in final demand for an industry's output backward through the industry's suppliers. As defined earlier, however, final demand includes government expenditures, exports and depreciation allowances. Households have already been placed in the Processing Sector. Because it would be difficult to justify the time needed to accurately estimate the remaining components of final demand, exports (i.e., regional output sold outside the region) will be used as a proxy. For our purposes, exports should be a reasonable substitute.

2/ See Appendix tables 1 and 2 for a complete list of the industries for which multipliers can be calculated.

3/ Appendix table 3 compares all the industrial multipliers calculated for the Chowan-Pasquotank.

4/ A complete example problem is found in Appendix 5.

AREA - CHOWAN-PASQUOTANK RIVER BASIN
SECTOR 11 - FORESTRY + FISHERY PRODUCTS

SIC CODE	INDUSTRY NAME	PROPORTION OF GROSS OUTPUT
01	FARMS	.1035
07	AGRICULTURAL SERVICES	.0230
08+09	FORESTRY AND FISHERIES	.0175
20	FOOD AND KINDRED PRODUCTS	.0122
23	APPAREL AND OTHER FABRICATED TEXTILE PRODUCTS	.0002
28	CHEMICALS AND ALLIED PRODUCTS	.0005
30	RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS	.0003
34	FABRICATED METALS PRODUCTS	*
372-379	OTHER TRANSPORTATION VECHICLES	.0027
42	MOTOR FREIGHT TRANSPORTATION AND WAREHOUSING	.0009
44	WATER TRANSPORTATION	.0049
49	PUBLIC UTILITIES	.0001
50	WHOLESALE TRADE	.0106
52-59	RETAIL TRADE	.0040
60	BANKING	.0027
62	SECURITY AND COMMODITY BROKERS, DEALERS AND SERVICE	*
63	INSURANCE CARRIERS, INCL SOLICITORS	.0002
65+66	REAL ESTATE AND COMBINATIONS	.0066
73	MISCELLANEOUS BUSINESS SERVICES	*
75	AUTO REPAIR AND SERVICES	.0018
	HOUSEHOLDS	.0890
	SUM OF DIRECT REQUIREMENTS COEFFICIENTS	.2810

* * * * * * * * * * * * MULTIPLIER AND COMPONENTS * * * * * * * * * * * *

DIRECT COMPONENT	INDIRECT-INDUCED COMPONENT	FINAL DEMAND MULTIPLIER
.281	.275	1.556

SOURCE: REGIONAL INDUSTRIAL MULTIPLIER SYSTEM
REGIONAL ECONOMIC ANALYSIS DIVISION
BUREAU OF ECONOMIC ANALYSIS

* LESS THAN .00005

Figure - 2 **REGIONALIZED DIRECT REQUIREMENT COEFFICIENTS**

(INDUSTRY 2411 - LOGGING CAMPS + LOGGING CONTRACTORS)

SIC CODE	AREA - CHOWAN-PASQUOTANK RIVER BASIN INDUSTRY NAME	PROPORTION OF GROSS OUTPUT
01	FARMS	.0404
08+09	FORESTRY AND FISHERIES	.3284
15-17	CONTRACT CONSTRUCTION	.0027
23	APPAREL AND OTHER FABRICATED TEXTILE PRODUCTS	.0007
24	LUMBER AND WOOD PRODUCTS, EXC FURNITURE	.1053
25	FURNITURE AND FIXTURES	.0001
26	PAPER AND ALLIED PRODUCTS	.0010
27	PRINTING, PUBLISHING AND ALLIED PRODUCTS	*
28	CHEMICALS AND ALLIED PRODUCTS	.0033
30	RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS	.0012
32	STONE, CLAY AND GLASS PRODUCTS	*
33	PRIMARY METALS INDUSTRIES	.0010
34	FABRICATED METALS PRODUCTS	.0005
35	MACHINERY EXCEPT ELECTRICAL	.0002
39	MISCELLANEOUS MANUFACTURING	.0004
42	MOTOR FREIGHT TRANSPORTATION AND WAREHOUSING	.0008
44	WATER TRANSPORTATION	.0008
48	COMMUNICATIONS	.0002
49	PUBLIC UTILITIES	.0016
50	WHOLESALE TRADE	.0079
52-59	RETAIL TRADE	.0024
60	BANKING	.0007
62	SECURITY AND COMMODITY BROKERS, DEALERS AND SERVICE	*
63	INSURANCE CARRIERS, INCL SOLICITORS	.0002
65+66	REAL ESTATE AND COMBINATIONS	.0037
73	MISCELLANEOUS BUSINESS SERVICES	.0030
75	AUTO REPAIR AND SERVICES	.0054
81+89	LEGAL AND MISCELLANEOUS PROFESSIONAL SERVICES	.0010
84+86	MUSEUMS AND NONPROFIT MEMBERSHIP ORGANIZATIONS	.0001
	HOUSEHOLDS	.2198
	SUM OF DIRECT REQUIREMENTS COEFFICIENTS	.7330

* * * * * * * * * * * * MULTIPLIER AND COMPONENTS * * * * * * * * * * * *

DIRECT COMPONENT	INDIRECT-INDUCED COMPONENT	FINAL DEMAND MULTIPLIER
.733	.739	2.472

SOURCE: REGIONAL INDUSTRIAL MULTIPLIER SYSTEM
REGIONAL ECONOMIC ANALYSIS DIVISION
BUREAU OF ECONOMIC ANALYSIS

* LESS THAN .00005

Figure - 3 **REGIONALIZED DIRECT REQUIREMENT COEFFICIENTS**

It is important at this point to remember why we are focusing on changes in the demand for exports as well as changes in output as a result of a river basin project. As mentioned in the description of the Input-Output model, the Final Demand sector is the only autonomous sector and any change in production in the Processing Sector is a response to a change in demand. In order to analyze the impact of our projects or programs, we must therefore begin by estimating the changes in demand which made the programs necessary. Changes in demand are, through river basin projects and programs, translated into changes in total gross output, which in turn affects income and employment in the region.

The original change in demand for exports may be assumed or the analyst might calculate the change in demand for exports based on projected changes in total demand. Although the OBERS 5/ projections offer some conceptual difficulties, they provide a possible starting point for the analyst. If we assume that changes in demand occur evenly throughout the economy, we may also assume that the proportion of industry output which is exported remains the same (1). Future demand for exports is therefore:

$$D_E = D_T(E) \qquad (1)$$

where D_E is the demand for the industry's exports, D_T is total demand for the industry's product and E is the percent of output which is exported. In the Chowan-Pasquotank, for example, 46 percent of all roundwood is currently exported from the region and projected demand for roundwood in 1980 is 152.6 million cubic feet. The associated demand for exports is estimated as:

$$D_E = 152.6\ (.46)$$

$$= 70.2 \text{ million cubic feet.}$$

The change in the demand for exports is then:

$$\Delta D_E = D_{Et_1} - D_{Et_0} \qquad (2)$$

where D_{Et_0} is the demand for exports in the base year and D_{Et_1} is the demand for exports in the project year. The initial impact of this change on the regional economy is equal to the dollar value of the change in output exported. The change in total gross output (ΔTGO), however, is equal to the initial change in exports times the multiplier for that industry:

$$\Delta TGO = D_{E_j}(M_j) \qquad (3)$$

If, for example, some project or program results in a $10,000 increase in the value of the exported output of the Forest Products sector, equation 3 tells us that the total regional impact will be:

$$\Delta TGO = 10{,}000\ (M_j)$$

5/ Under a cooperative agreement with the Water Resources Council, (BEA), formerly the Office of Business Economics (OBE), U.S. Department of Commerce, and the Economic Research Service (ERS), U.S. Department of Agriculture, developed a series of economic projections whihc are used in comprehensive water resources planning programs. Although the OBE has been renamed the BEA, the term OBERS has continued in use as the title of the projection series.

In the Chowan-Pasquotank River Basin, where the Forest Products multiplier (from Figure 2) is 1.556:

$$\Delta TGO = 10{,}000\ (1.556)$$

$$= 15{,}560$$

The total impact of a $10,000 change in the demand for exported roundwood is $15,560. Because we are using an output multiplier, the $15,560 represents a change in the value of output, not income or earnings. A technique for translating changes in total gross output to the more valuable measures of earnings and employment will be discussed on page 11.

The analyst must be cautioned at this point to remember that the technical coefficients were determined for the specific technology and the specific pattern of industry trade and relative prices which existed in the year for which the national I-O table was constructed. The coefficients are, therefore, assumed to remain constant throughout the period of analysis. There must be sufficient idle plant capacity in the region to handle increases in the demand for exports, because new facilities cannot be built or existing ones enlarged without changing the industry's inputs and, therefore, changing the technical coefficients (3,4). In the Forest Products sector, this means that there must be sufficient commercial forest land with the productive capacity to meet increasing demand.

Forward Linkage Effects [6/]

Using the RIMS multipliers through forward linkages is not quite so straightforward. If a project affects the output of an industry which sells all or part of its product to another industry in the region, the sale represents an interindustry flow and the analyst must determine if a forward linkage exists. One cannot assume, for example, that an increase in the amount of locally produced roundwood sold to the region's wood processing industry is a result of an increase in local wood processing. Locally produced roundwood might simply be substituted for imported wood and the processing industry's output and other inputs would be unchanged. A forward link is present only when there is a net change in the output of the processing industry.

Where a forward linkage can be established and it is determined that the processing industry exports its output, then the impact on the project industry is derived from a change in the demand for exports of the forward-link industry. Given this change in demand for exports, the evaluation of secondary impacts can proceed and the results will include all the backward linkages in the production process, including the impact of the change in the project industry.

Assume for example that a project or program alternative affects industry i such that it is expected to increase its output by an amount X_i. The increased output of i will be processed by industry j -- the forward-link industry. If one assumes that the entire output of j is exported, then the relationship between the change in exports for industry j and X_i is:

$$\Delta D_{E_j} = X_i(1/a_{ij}) \qquad (4)$$

Where a_{ij} is the technical coefficient representing sales from i to j. Thus, if a project designed to increase timber production in the Chowan-Pasquotank resulted in a $10,000 increase in wood sold by the Forest Products sector to Logging Camps and Contractors (from Figure 3), the associated demand change in wood processing would be:

$$\Delta D_{E_j} = 10,000\ (1/.3284)$$

$$= 30,450.$$

Using equation 3 and the multiplier for the logging sector from figure 3, the total regional impact is:

$$\Delta TGO = 30,450(2.472)$$

$$= 75,274.$$

As stated earlier, this impact figure includes all the backward linkages in the production process, including the impact of the original $10,000 change in the output of the Forest Products sector.

6/ A complete example is found in Appendix 5.

Again, the analyst is cautioned to recall that these calculations apply only if the increase in wood sold to the processing industry represents a net increase in wood bought by the processor. If, instead, the processor is substituting a locally grown product for an imported one, the relationship does not hold.

Futhermore, the analyst must be cautious about going too far in attributing forward linkages to the provision of a single input. One should not, for example, go so far as to attribute increased housing construction to the increased availability of sawtimber. This assumption would ignore the fact that there are many other inputs of housing construction. It must be remembered that the demand for wood products and other raw materials is a "derived demand"--that is, the demand for wood products is a result of the demand for houses, paper, boxes and other items made from wood, not the other way around.

Once changes in regional total gross output have been calculated using equation 3, the related changes in earnings and employment can also be estimated. Total gross output changes can be divided into two components: one which results from the initial change in the demand for exports and one which reflects that change through the rest of the economy. For a given change in the demand for the exports of industry j (ΔD_{E_j}), the reciprocal of the multiplier ($1/M_j$) indicates the proportion of total gross output change occurring in industry j, while $1 - 1/M_j$ indicates the proportion of output change taking place in the rest of the economy. Using these proportions and the average earnings/gross output ratio in the United States, we can calculate a factor e_j for converting a change in gross output to a change in earnings:

$$ej = (1/M_j)(a_{hj}) + (1 - 1/M_j)(E.) \qquad (5)$$

where M_j is the regional multiplier for industry j, a_{hj} is the household coefficient for industry j and E. is the national earnings/gross output ratio. E. was .3008 in 1967, the most recent year for which a gross-output value is available from the BEA national input-output model.

Given e_j, the regional total earnings impact from an initial change in demand for exports of industry j is:

$$\Delta TE = \Delta TGO_j(e_j) \qquad (6)$$

Continuing with our example from page 9 , where a $10,000 increase in the exports of the Forest Products sector resulted in a $15,560 change in total gross output from the region, and taking the household coefficient a_{hj} and the multiplier M_j from Figure 2, we have:

$$e_j = (1/1.556)(.0890) + (1 - 1/1.566)(.3008)$$

$$= .0572 + .1075$$

$$= .1647$$

Using equation 6 we calculate the change in total earning as:

$$\Delta TE = 15,560\ (.1647)$$

$$= 2,562.$$

The result, then, of a $10,000 increase in the exports of the Forest Products sector in the Chowan-Pasquotank River Basin will be a $15,560 increase in total gross output,

of which $2,562 represents increased earnings of employed persons in the region.

Once the impact on earnings has been estimated, the associated change in employment can also be determined. OBERS (8) offers earnings and employment data[7/] from which the analyst can calculate a factor f, the employment/earnings ratio. The regional employment impact is:

$$\Delta TM = \Delta TE(f) \qquad (7)$$

where ΔTM is the change in total employment and ΔTE is the change in total earnings. In the Chowan-Pasquotank River Basins, the following calculation results:

$$f = \frac{\text{total employment in the region in 1980}}{\text{total earnings in the region in 1980}}$$

$$= 520,800/3,744,900,000$$

$$= .00014$$

Applying that factor to our previous example and using equation 7, we obtain:

$$\Delta TM = 2562(.00014)$$

$$= .36$$

The initial $10,000 change in demand for the exports of the Forest Products sector has therefore resulted in a $15,560 increase in the gross output of the region, a $2,562 increase in earnings and one-third of a new job (which might be interpreted as four month's employment for one person).

The same procedure is used to trace the effects of a decline in demand for exports, or the decreasing or discontinuance of an export activity for some other reason. In the foregoing example, a $10,000 decrease in the demand for exports of the Forest Products sector would result in a $15,560 decrease in the gross output of the region, a $2,562 decrease in earnings and the loss of one-third of a job. The effect would be similar if, for example, timber harvesting on a National Forest was reduced because of a policy change, or a resort beach had to close because of polluted water. Negative impacts would be transmitted through the regional economy because of the multiplier effect.

V. Information Needs

In order to use the RIMS multipliers effectively, the analyst must have access to certain other types of information. If the analysis is to be made in dollars, for example, product prices must be known or estimated so that output figures, such as cords of pulpwood, can be expressed in terms of their dollar value.

7/ Earnings and employment projections are available by BEA Economic Area (Vol. 2) Water Resource Regions and Subareas (Vol. 3) and State (Vol. 4). Because the data are not available by river basin, one of these other regions may be used to approximate f for the river basin.

Because exports are used as a proxy for Final Demand, it is essential to have an estimate of the proportion of regional output of each product which is processed within the region and of the quantity exported. For the Forest Products sector (in the East, at any rate), that information is available from the Forest Service Research Stations, each of which conducts periodic industry surveys and makes price and product drain reports. (See Appendix table 4 for an example of information available from the Stations.)

The analyst must also have some knowledge of the level of technology used in the region, since the technical coefficients produced by RIMS reflect the national average level of technology in each industry. If it is known that some of the region's industries do not conform to the national average, adjustments can be made in the technical coefficients prior to the final RIMS calculations made by BEA. The technical coefficients and the multiplier would then be a more accurate reflection of the actual level of technology in the region.

VI. Summary and Conclusions

We have mentioned both advantages and disadvantages of RIMS and added several cautionary notes for the analyst. Effective analysis requires an awareness of limitations on the application and interpretations of the results. When using RIMS, the analyst should keep several points in mind:

1. The analysis assumes only the industry output will change; everything else, such as technology and regional industrial structure, will remain constant. In other words, we assume that the future will be exactly like the past. Other changes occurring in the region, such as the substitution of goods and services produced in the region, the inputs used by the production process, or consumer tastes for goods and services must be evaluated by the analyst. In reality, the technical coefficients are affected by changes in the relative prices of the factors of production, the appearance of new industries and the disappearance of old, and by changes in technology. These changes cannot be foreseen, however, and the analyst must simply try to take them into consideration as they appear.

2. Because RIMS only compares two points in time, one sees only a before-and-after situation. The dynamics of how an initial impact is transmitted through the economy are not examined.

3. Adjustments in the regional economy are assumed to be instantaneous. There are no consumption or production lags and no migration or inventory adjustment lags. Consumers are assumed to display the same tendencies to spend and save earned income regardless of expansions or contractions of the economy. To the extent that changes in spending are less than proportional to changes in income, the induced portion of the multipliers overstates consumer spending. This problem cannot be overcome, but should be acknowledged by the analyst.

4. It is assumed that there are no supply restrictions. This is an important point to remember, because many analysts predict that future wood supplies cannot keep pace with growing demand. Although there are techniques for dealing with the problem (1), they generally require a full-fledged I-O model and thus are not applicable to RIMS.

RIMS has several advantages to weigh against the restrictions. Chief among these are its cost effectiveness and its reliability. Because the system is almost completely computerized, RIMS output is rapidly available and inexpensive. For the 29-county Chowan-Pasquotank River Basins Study Area, reasonably accurate multipliers for all 56 economic sectors and 17 specific industries were purchased for about $1,000.

Acquiring multipliers for all 56 economic sectors enables the analyst to estimate impacts of changes in sectors other than the forest and forestry industry sectors. For example, projects which affect agricultural production or recreation and service facilities may also be analyzed.

Although some object to any type of regional I-O which depends upon secondary data, there have been studies which support the validity of such models (6). The reliability of RIMS has also been satisfactorily documented (2). The system is valuable, therefore, because it enables the analyst to perform cost effective, timely regional economic analysis.

Procedure for Ordering RIMS Output

Contact: Ronald L. Drake, Chief
Analysis Branch
Bureau of Economic Analysis
Department of Commerce
Washington, D.C. 20230

Supply BEA with:

1. List of the counties which make up the region of interest, and

2. List of the sectors and/or industries for which multipliers are desired.

This report was substantially complete when Water Resources Council Guideline 5: Regional Multipliers was released. The author had access to preliminary work on Guideline 5 and that work is acknowledged in references 2, 5 and 7.

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Appendix Table 1 -- Sectors for which RIMS will calculate multipliers

Sector No.	Industry title	SIC codes (1958)
1.	Dairy farm products	0132, pt. 014, pt. 02
2.	Poultry and eggs	0133, pt. 014, pt. 02
3.	Meat, animals, and miscellaneous livestock products	0139, pt. 014, 0193, pt. 0729, pt. 02
4.	Cotton	0112, pt. 014, pt. 02
5.	Food, feed grains, and grass seeds	0113, pt. 0119, pt. 014, pt. 02
6.	Tobacco	pt. 0119, pt. 014, pt. 02
7.	Fruits and tree nuts	0122, pt. 014, pt. 02
8.	Vegetables, sugar and misc. crops	0123, pt. 0119, pt. 014 pt. 02
9.	Oil bearing crops	pt. 0119, pt. 014, pt. 02
10.	Forest, greenhouse, and nursery products	pt. 0192, pt. 014, pt. 02
11.	Forestry and fishery products	074, 081, 082, 084, 086, 091
12.	Agricultural forestry and fishery services	071, 0723, 073, pt. 0729, 085, 098
13.	Metal mining	10
14.	Anthracite mining, bituminous coal and lignite mining	11, 12
15.	Oil and gas extraction	13
16.	Nonmetallic minerals, except fuels and chem. and fertlizer mineral mining	14 excl. 147
17.	Chemical and fertilizer minerals	147

Table 1 (continued)

Sector No.	Industry title	SIC codes (1958)
18.	General building contractors heavy construction contracts special trade contractors	15 16 17
19.	Meat products	201
20.	Creamery butter	2021
21.	Cheese, natural and processed	2022
22.	Condensed and evaporated milk	2023
23.	Ice cream and frozen desserts	2024
24.	Fluid milk	2026
25.	Canned specialties canned fruits and vegetables	2032 2033
26.	Fresh or frozen packaged fish	2036
27.	Frozen meats and vegetables	2037
28.	Flour and other grain mill products, cereal prep., and rice milling, blended and prepared flour, and wet corn milling	2041, 2043-6
29.	Prepared feeds for animals and fowls	2042
30.	Cottonseed	2091
31.	Oil mills soybean vegetable oil mills, nec.	2091-3 2092 2093
32.	Animal and marine fats and oils	2094
33.	Shortening and cooking oils	2096
34.	Other food products	2031, 2034-5, 205, 207, 208, 2095, 2097-9
35.	Tobacco manufacturing	21

Table 1 (continued)

36.	Textile mill prod.; apparel and other textile prod.	22, 23
37.	Logging camps and logging contractors	2411
38.	Lumber and wood prod. excpt. logging camps and logging contractors and wooden cont.	24 excpt. 241, 244
39.	Wooden containers; furniture and fixtures	244, 25
40.	Paper and allied prod.	26
41.	Printing, publishing	27
42.	Chemicals and allied prod.	28
43.	Petroleum and coal prod.	29
44.	Rubber and plastics prod. nec.	30
45.	Leather and leather prod.	31
46.	Stone, clay, and glass prod.	32
47.	Primary metal industries	33
48.	Fabricated metal prod.	34
49.	Machinery excpt. electrical	35
50.	Electrical equip. and supplies	36
51.	Transportation equipment	37
52.	Ordance and accessories instruments related prod. misc. mfc. industries	19 38 39
53.	Transportation communications and utilities	40-49
54.	Wholesale and retail trade	50-59
55.	Finance, insurance and real estate	60-67
56.	Services	70-89

Appendix Table 2 -- Industries for which RIMS will calculate multipliers

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
Agriculture forestry and fisheries	
0101 Dairy farm products	0132, pt. 014 pt. 02
0102 Poultry & eggs	0133, pt. 014, pt. 02
0103 Meat, animals & misc. livestock products	0139, pt. 014, 0193, pt. 0729, pt. 02
0201 Cotton	0112, pt. 014, pt. 02
0202 Food feed grains & grass seeds	0113, pt. 0119, pt. 014, pt. 02
0203 Tobacco	pt. 0119, pt. 014 pt. 02
0204 Fruits & tree nuts	0122, pt. 014, pt. 02
0205 Vegetables, sugar & misc. crops	0123, pt. 0119, pt. 014, pt. 02
0206 Oil bearing crops	pt. 0119, pt. 014, pt. 02
0207 Forest, greenhouse & nursery products	0192, pt. 014, pt. 02
0300 Forestry & fishery products	074, 081, 082, 084, 086, 091
0400 Agricultural, forestry & fishery services	071, 0723, 073, pt. 0729, 085, 098
Mining	
0500 Iron & ferroalloy ores mining	1011, 106
0601 Copper ore mining	102
0602 Nonferrous metal ores mining, except copper	103, 104, 105, 108, 109
0700 Coal mining	11, 12
0800 Crude petroleum & natural gas	1311, 1321
0900 Stone & clay mining & quarrying	141, 142, 144 145, 148, 149
1000 Chemical & fertilizer mineral mining	147
Construction	
1503 New residential single family housing, nonfarm	pt. 15, pt. 17, pt. 6561
1504 New residential two-four family housing	pt. 15, pt. 17 pt. 656
1505 New residential garden apartments	pt. 15, pt. 16, pt. 17
1506 New residential high-rise apartments	pt. 15, pt. 16 pt. 17
1507 New residential alterations & additions	pt. 15, pt. 17
1508 New hotels & motels	pt. 15, pt. 17

Appendix Table 2 -- (Cont.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
1509 New dormitories	pt. 15, pt. 17
1511 New industrial buildings	pt. 15, pt. 17
1512 New office buildings	pt. 15, pt. 17
1513 New warehouses	pt. 15, pt. 17
1514 New garages & service stations	pt. 15, pt. 17
1515 New stores & restaurants	pt. 15, pt. 17
1516 New religious buildings	pt. 15, pt. 17
1517 New education buildings	pt. 15, pt. 17
1518 New hospital buildings	pt. 15, pt. 17
1519 New other nonfarm buildings	pt. 15, pt. 17
1601 New telephone & telegraph facilities	pt. 16, pt. 17
1602 New railroads	pt. 16, pt. 17
1603 New electric utility facilities	pt. 16, pt. 17
1604 New gas utility facilities	pt. 16, pt. 17
1605 New petroleum pipelines	pt. 16, pt. 17
1606 New water supply facilities	pt. 16, pt. 17
1607 New sewer facilities	pt. 16, pt. 17
1608 New local transit facilities	pt. 16, pt. 17
1610 New highways	pt. 16, pt. 17
1621 New farm residential buildings	pt. 15, pt. 17
1622 New farm service facilities	pt. 15, pt. 17
1623 New oil & gas wells	pt. 138
1624 New oil & gas exploration	pt. 138
1625 New military facilities	pt. 15, pt. 16, pt. 17
1626 New conservation & development facilities	pt. 15, pt. 16, pt. 17
1627 Other new nonbuilding facilities	pt. 15, pt. 16, pt. 17
1710 Maintenance & repair, residential	pt. 15, pt. 17
1721 Maintenance & repair of other nonfarm buildings	pt. 15, pt. 17
1722 Maintenance & repair of farm residential	pt. 15, pt. 17
1723 Maintenance & repair of farm service facilities	pt. 15, pt. 17
1724 Maintenance & repair of telephone & telegraph facilities	pt. 16, pt. 17
1725 Maintenance & repair of railroads	pt. 16, pt. 17
1726 Maintenance & repair of electric utility facilities	pt. 16, pt. 17
1727 Maintenance & repair of gas utility facilities	pt. 16, pt. 17
1728 Maintenance & repair of petroleum pipelines	pt. 16, pt. 17
1729 Maintenance & repair of water supply facilities	pt. 16, pt. 16
1731 Maintenance & repair of sewer facilities	pt. 16, pt. 17
1732 Maintenance & repair of local transit facilities	pt. 16, pt. 17
1733 Maintenance & repair of military facilities	pt. 15, pt. 16 pt. 17
1734 Maintenance & repair of conservation & development facilities	pt. 15, pt. 16, pt. 17

Appendix Table 2 -- (cont'd.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
1735 Maintenance & repair of highways	pt. 16, pt. 17
1736 Maintenance & repair of oil & gas wells	pt. 138
1737 Maintenance & repair of other nonbuilding facilities	pt. 15, pt. 16, pt. 17
Manufacturing	
1419 Sugar	206
1701 Floor coverings	227
1804 Apparel made from purchased Materials	23 (exc 239), 3992
1925 Complete guided missiles	1925
1929 Ammunition, exc. for small arms, n.e.c.	1929
1931 Tanks & tank components	1931
1941 Sighting & fire control equip.	1941
1951 Small arms	1951
1961 Small arms ammunition	1961
1990 Other ordnance & accessories	1911, 1999
2011 Meat packing plants	2011
2013 Sausages & other prepared meats	2013
2015 Poultry dressing plants	2015
2021 Creamery butter	2021
2022 Cheese, natural & processed	2022
2023 Condensed & evaporated milk	2023
2024 Ice cream & frozen desserts	2024
2026 Fluid milk	2026
2031 Canned & cured sea foods	2031
2032 Canned specialties	2032
2033 Canned fruits & vegetables	2033
2034 Dehydrated food products	2034
2035 Pickles, sauces, & salad dressings	2035
2036 Fresh or frozen packaged fish	2036
2037 Frozen fruits & vegetables	2037
2041 Flour & other grain mill products	2041
2042 Prepared feeds for animals & fowls	2042
2043 Cereal preparations	2043
2044 Rice milling	2044
2045 Blended & prepared flour	2045
2046 Wet corn milling	2046
2051 Bread, cake, & related products	2051
2052 Cookies & crackers	2052
2071 Confectionery products	2071
2072 Chocolate & cocoa products	2072
2073 Chewing gum	2073
2082 Malt liquors	2082
2083 Malt	2083
2084 Wines, brandy, & brandy spirits	2084
2085 Distilled liquor, except brandy	2085
2086 Bottled & canned soft drinks	2086
2087 Flavoring extracts & syrups, n.e.c.	2087
2091 Cottonseed oil mills	2091
2092 Soybean oil mills	2092
2093 Vegetable oil mills, n.e.c.	2093
2094 Animal & marine fats & oils	2094
2095 Roasted coffee	2095

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
2096 Shortening & cooking oils	2096
2097 Manufactured ice	2097
2098 Macaroni & spaghetti	2098
2099 Food preparations, n.e.c.	2099
2100 Wooden containers	244
2111 Cigarettes	2111
2121 Cigars	2121
2131 Chewing & smoking tobacco	2131
2141 Tabacco stemming & redrying	2141
2201 Broadwoven fabric mills & fabric finishing plants	2211, 2221, 2231, 2261, 2262
2241 Narrow fabric mills	2241
2251 Women's hosiery, except socks	2251
2252 Hosiery, n.e.c.	2252
2253 Knit outerwear mills	2253
2254 Knit underwear mills	2254
2256 Knit fabric mills	2256
2259 Knitting mills, n.e.c.	2259
2280 Yarn mills & finishing of textiles, n.e.c.	2269, 2281-3
2284 Thread mills	2284
2291 Felt goods, n.e.c.	2291
2292 Lace goods	2292
2293 Paddings & upholstery filling	2293
2294 Processed textile waste	2294
2295 Coated fabrics, not rubberized	2295
2296 Tire cord & fabric	2296
2297 Scouring & combing plants	2297
2298 Cordage & twine	2298
2299 Textile goods, n.e.c.	2299
2391 Curtains & draperies	2391
2392 Housefurnishings, n.e.c.	2392
2393 Textile bags	2393
2394 Canvas products	2394
2395 Pleating & stitching	2395
2396 Automotive & apparel trimmings	2396
2397 Schiffli machine embroideries	2397
2399 Fabricated textile products,n.e.c.	2399
2411 Logging camps, & logging contractors	2411
2421 Sawmills & planing mills, general	2421
2426 Hardwood dimension & flooring	2426
2429 Special product sawmills, n.e.c.	2429
2431 Millwork	2431
2432 Veneor & plywood	2432
2433 Prefabricated wood structures	2433
2491 Wood preserving	2491
2499 Wood products, n.e.c.	2499
2500 Paperboard containers & boxes	265
2511 Wood household furniture	2511
2512 Upholstered household furniture	2515
2514 Metal household furniture	2514
2515 Mattresses & bedsprings	2515
2519 Household furniture, n.e.c.	2519
2521 Wood office furniture	2521
2522 Metal office furniture	2522
2531 Public building furniture	2531
2541 Wood partitions & fixtures	2541
2542 Metal partitions & fixtures	2542
2591 Venetian blinds & shades	2591
2599 Furniture & fixtures, n.e.c.	2599

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Appendix Table 2 -- (cont'd.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
2605 Commercial printing	2751, 2752
2611 Pulp mills	2611
2621 Paper mills, except building paper	2621
2631 Paperboard mills	2631
2641 Paper coating & glazing	2641
2642 Envelopes	2642
2643 Bags, except textile bags	2643
2644 Wallpaper	2644
2645 Die cut paper & board	2645
2646 Pressed & molded pulp goods	2646
2647 Sanitary paper products	2647
2649 Converted paper products, n.e.c.	2649
2661 Building paper & board mills	2661
2701 Industricl inorganic & organic chemicals	281 exc. 28195
2711 Newspapers	2711
2721 Periodicals	2721
2731 Book publishing	2731
2732 Book printing	2732
2741 Miscellaneous publishing	2741
2753 Engraving & plate printing	2753
2761 Manifold business forms	2761
2771 Greeting card publishing	2771
2782 Blankbooks & looseleaf binders	2782
2789 Bookbinding & related work	2789
2791 Typesetting	2791
2793 Photoengraving	2793
2794 Electrotyping & stereotyping	2794
2821 Plastics materials & resins	2821
2822 Synthetic rubber	2822
2823 Cellulosic man-made fibers	2823
2824 Organic fibers, noncellulosic	2824
2841 Soap & other detergents	2841
2842 Polishes & sanitation goods	2842
2843 Surface active agents	2843
2844 Toilet preparations	2844
2851 Paints & allied products	2851
2861 Gum & wood chemicals	2861
2871 Fertilizers	2871
2872 Fertilizers, mixing only	2872
2879 Agricultural chemicals, n.e.c.	2879
2891 Adhesives & gelatin	2891
2892 Explosives	2892
2893 Printing ink	2893
2895 Carbon black	2895
2899 Chemical preparations, n.e.c.	2899
2901 Drugs	283
2951 Paving mixtures & blocks	2951
2952 Asphalt felts & coatings	2952
3011 Tires & inner tubes	3011
3021 Rubber footwear	3021
3031 Reclaimed rubber	3031
3069 Fabricated rubber products, n.e.c.	3069
3079 Miscellaneous plastics products	3079
3101 Petroleum refining & related products	2911, 299
3111 Leather tanning & finishing	3111
3121 Industrial leather belting	3121
3131 Footwear cut stock	3131
3141 Shoes, except rubber	3141
3142 House slippers	3142
3151 Leather gloves & mittens	3151

Appendix Table 2 -- (cont'd.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
3161 Luggage	3161
3171 Women's handbags & purses	3171
3172 Personal leather goods	3172
3199 Leather goods, n.e.c.	3199
3221 Glass containers	3221
3241 Cement, hydraulic	3241
3251 Brick & structural clay tile	3251
3253 Ceramic wall & floor tile	3253
3255 Clay refractories	3255
3259 Structural clay products, n.e.c.	3259
3261 Vitreous plumbing fixtures	3261
3262 Vitreous china food utensils	3262
3263 Fine eathenware food utensils	3263
3264 Porcelain electrical supplies	3264
3269 Pottery products, n.e.c.	3269
3271 Concrete block & brick	3271
3272 Concrete products, n.e.c.	3272
3273 Ready-mixed concrete	3273
3274 Lime	3274
3275 Gypsum products	3275
3281 Cut stone & stone products	3281
3291 Abrasive products	3291
3292 Asbestos products	3292
3293 Gaskets & insulations	3293
3295 Minerals, ground or treated	3295
3296 Mineral wool	3296
3297 Nonclay refractories	3297
3299 Nonmetallic mineral products,n.e.c.	3299
3312 Blast furnaces & steel mills	3312
3313 Electrometallurgical products	3313
3315 Ste l wire & related products	3315
3316 Cold finishing of steel shapes	3316
3317 Stell pipe & tubes	3317
3331 Primary copper	3331
3332 Primary lead	3332
3333 Primary zinc	3333
3334 Primary aluminum	3334, 28195
3339 Primary nonferrous metals, n.e.c.	3339
3341 Secondary nonferrous metals	3341
3351 Copper rolling & drawing	3351
3352 Aluminum rolling & drawing	3352
3356 Nonferrous rolling & drawing,n.e.c.	3356
3357 Nonferrous wire drawing & insulating	3357
3361 Aluminum castings	3361
3362 Brass, bronze, & copper castings	3362
3369 Nonferrous castings, n.e.c.	3369
3391 Iron & steel forgings	3391
3392 Nonferrous forgings	3392
3399 Primary metal products, n.e.c.	3399
3411 Metal cans	3411
3421 Cutlery	3421
3423 Hand & edge tools, n.e.c.	3423
3425 Hand saws & saw blades	3425
3429 Hardware, n.e.c.	3429
3431 Metal sanitary ware	3431
3432 Plumbing fittings & brass goods	3432
3433 Heating equipment, except electric	3433
3441 Fabricated structural steel	3441
3442 Metal doors, sash, & trim	3442
3443 Fabricated plate work (boiler shops)	3443

Appendix Table 2 -- (cont'd.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
3444 Sheet metal work	3444
3446 Architectural metal work	3446
3449 Miscellaneous metal work	3449
3461 Metal stampings	3461
3471 Plating & polishing	3471
3479 Metal coating & allied services	3479
3481 Miscellaneous fabricated wire products	3481
3491 Metal barrels, drums, & pails	3491
3492 Safes & vaults	3492
3493 Steel springs	3493
3496 Collapsible tubes	3496
3497 Metal foil & leaf	3497
3499 Fabricated metal products, n.e.c.	3499
3501 Gloss & gloss products exc. containers	3211,3229,3231
3511 Steam engines & turbines	3511
3519 Internal combustion engines, n.e.c.	3519
3522 Farm machinery	3522
3531 Construction machinery	3531
3532 Mining machinery	3532
3533 Oil field machinery	3533
3534 Elevators & moving stairways	3534
3535 Conveyers & conveying equipment	3535
3536 Hoists, cranes, & monorails	3536
3537 Industrial trucks & tractors	3537
3541 Machine tools, metal cutting types	3541
3542 Machine tools, metal forming types	3542
3548 Metalworking machinery, n.e.c.	3548
3551 Food products machinery	3551
3552 Textile machinery	3552
3553 Woodworking machinery	3553
3554 Paper industries machinery	3554
3555 Printing trades machinery	3555
3559 Special industry machine, n.e.c.	3559
3561 Pumps & compressors	3561
3562 Ball & roller bearings	3562
3564 Blowers & fans	3564
3565 Industrial patterns	3565
3566 Power transmission equipment	3566
3567 Industrial furnaces & ovens	3567
3569 General industrial machinery, n.e.c.	3569
3571 Computing & related machines	3571
3572 Typewriters	3572
3576 Scales & balances	3576
3579 Offices machines, n.e.c.	3579
3581 Automatic merchandising machines	3581
3582 Commercial laundry equipment	3682
3585 Refrigeration machinery	3585
3586 Measuring & dispensing pumps	3586
3589 Service industry machines, n.e.c.	3589
3599 Miscellaneous machinery, except n.e.c.	3599
3611 Electric measuring instruments	3611
3612 Transformers	3612
3613 Switchgear & switchboard	3613
3621 Motors & generators	3621
3622 Industrial controls	3622

Appendix Table 2 -- (cont'd.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
3623 Welding apparatus	3623
3624 Carbon & graphite products	3624
3629 Electrical industrial apparatus, n.e.c.	3629
3631 Household cooking equipment	3631
3632 Household refrigerators & freezers	3632
3633 Household laundry equipment	3633
3634 Electric housewares & fans	3634
3635 Household vacuum cleaners	3635
3636 Sewing machines	3636
3639 Household appliances, n.e.c.	3639
3641 Electric lamps	3641
3642 Lighting fixtures	3642
3651 Radio & TV receiving sets	3651
3652 Phonograph records	3652
3661 Telephone & telegraph apparatus	3661
3662 Radio & TV communication equipment	3662
3674 Semiconductors	3674
3670 Electronic components, n.e.c.	3670
3691 Storage batteries	3691
3692 Primary batteries, dry & wet	3692
3693 X-ray apparatus & tubes	3693
3694 Engine electrical equipment	3694
3699 Electrical equipment, n.e.c.	3699
3702 Iron & steel foundries	332
3713 Truck & bus bodies	3713
3715 Truck trailers	3715
3717 Motor vehicles & parts	3717
3721 Aircraft	3721
3722 Aircraft engines & engine parts	3722
3723 Aircraft propellers & parts	3723
3729 Aircraft equipment, n.e.c.	3729
3731 Shipbuilding & repairing	3731
3732 Boatbuilding & repairing	3732
3741 Locomotives & parts	3741
3742 Railroad & street cars	3742
3751 Motorcycles, bicycles, & parts	3751
3791 Trailer coaches	3791
3799 Transportation equipment, n.e.c.	3799
3811 Engineering & scientific instruments	3811
3821 Mechanical measuring devices	3821
3822 Automatic temperature controls	3822
3831 Optical instruments & lenses	3831
3841 Surgical & medical instruments	3841
3842 Surgical appliances & supplies	3842
3843 Dental equipment & supplies	3843
3851 Ophthalmic goods	3851
3861 Photographic equipment & supplies	3861
3871 Watches & clocks	3871
3872 Watchcases	3872
3911 Jewelry, precious metal	3911
3912 Jewelers' findings & materials	3912
3913 Lapidary work	3913
3914 Silverware & plated ware	3914
3931 Musical instruments & parts	3931
3941 Games & toys	3941
3942 Dolls	3942
3943 Children's vehicles, except bicycles	3943

Appendix Table 2 -- (cont'd.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
3949 Sporting & athletic goods, n.e.c.	3949
3951 Pens & mechanical pencils	3951
3952 Lead pencils & art goods	3952
3953 Marking devices	3953
3955 Carbon paper & inked ribbons	3955
3961 Costume jewelry	3961
3962 Artificial flowers	3962
3963 Buttons	3963
3964 Needles, pins, & fasteners	3964
3981 Brooms & brushes	3981
3982 Hard surface floor covering	3982
3983 Matches	3983
3984 Candles	3984
3987 Lamp shades	3987
3988 Morticians goods	3988
3993 Signs & advertising display	3993
3995 Umbrellas, parasols & canes	3995
3999 Miscellaneous products, n.e.c.	3999
4101 Screw machine products & bolts, nuts, rivets & washers	345
4208 Pipe, valves & pipe fittings	3494, 3498
4703 Special dies & tools & machine tool accessories	3544, 3545
5503 Wiring devices	3643, 3644
5701 Electron tubes	3671, 3672, 3673
Transportation, communication, electric, gas, & sanitary services	
6501 Railroads & related services	40, 474
6502 Local, suburban & interurban highway passenger transportation	41
6503 Motor freight transportation & warehousing	42, 473
6504 Water transportation	44
6505 Air transportation	45
6506 Pipe line transportation	46
6507 Transportation services	47, except 473
6600 Communications, except radio & television	48, except 483
6700 Radio & television broadcasting	483
6801 Electric utilities	491, pt. 493
6802 Gas utilities	492, pt. 493
6803 Water & sanitary services	494, 495, 496, pt. 493
Wholesale & retail trade	
6901 Wholesale trade	50 (except manufacturers' sale offices)
6902 Retail trade	52, 53, 54, 55, 57, 58, 59, 73
Finance, insurance & real estate	
7001 Banking	60
7002 Credit agencies	61, 67
7003 Security & commodity brokers	62
7004 Insurance carriers	63
7005 Insurance agents & brokers	64
7101 Owner-occupied dwellings	NA
7102 Real estate	65 (except pt. 6561), 66

Appendix Table 2 -- (cont'd.)

Industry Classification for the 478 Level 1963 Input-Output Table

Industry number and title	Related SIC or Census codes
Services	
7201 Hotels & lodging places	70
7202 Personal & repair services, except auto repair, barber, & beauty shops	72 (except 723, 724), 76 (except 7694 & pt. 7699)
7203 Barber & beauty shops	723, 724
7301 Miscellaneous business services	73 (except 731, 7396), 7694, pt. 7699
7302 Advertising	731
7303 Miscellaneous professional services	81, 89 (except 8921)
7500 Automobile repair & services	75
7601 Motion pictures	78
7602 Amusement & recreation services	79
7701 Doctors & dentists	801, 802, 803, 804
7702 Hospitals	8061
7703 Other medical & health services	0722, 807, 809
7704 Educational services	82
7705 Nonprofit organizations	84, 86, 8921

Appendix Table 3 -- Final demand multipliers Chowan-Pasquotank River Basin

SECTORS

Sector No.	Sector	Final demand multiplier
1	Dairy farm products	2.403
2	Poultry and eggs	1.895
3	Meat animals and misc. livestock products	2.581
4	Cotton	2.043
5	Food, feed grains and grass seed	2.088
6	Tobacco	2.001
7	Fruits and tree nuts	2.177
8	Vegetables, sugar and misc. crops	2.171
9	Oil bearing crops	2.151
10	Forest, greenhouse and nursery products	1.985
11	Forestry, fishery products	1.556
12	Agricultural, forestry and fishery service	2.609
14	Coal mining	2.015
16	Nonmetallic mineral mining except chemical	1.903
18	Construction	1.458
19	Meat products	2.836
23	Ice cream and frozen desserts	2.383
24	Fluid milk	2.681
26	Fresh and frozen packaged fish	2.538
28	Grain mill products, nec.	2.253
31	Cottonseed, soybean & vegetable oil mill	1.730
34	Other food products	1.867
35	Tobacco manufactures	2.746
36	Textile mill-apparel products	2.130
37	Logging camps and contractors	2.472
38	Lumber and wood products, nec.	2.051
39	Wooden containers, furniture and fixtures	2.293
40	Paper and allied products	2.073
41	Printing and publishing	2.355

Appendix Table 3 -- (cont'd.)

Sector No.	Sector	Final demand multiplier
42	Chemical and allied products	1.752
44	Rubber and plastic products, nec.	2.131
45	Leather and leather products	1.964
46	Stone, clay and glass products	2.202
47	Primary metal industries	1.617
48	Fabricated metal products	1.782
49	Nonelectric machinery	1.839
50	Electric machinery, equipment and supplies	2.151
51	Transportation equipment	1.977
52	Misc. manufacturing, nec.	1.999
53	Transportation, communications, and utilities	1.255
54	Wholesale and retail trade	1.282
55	Finance, insurance and real estate	1.460
56	Services	1.356

INDUSTRIES

Sector No.	Industry	Final demand multiplier
2110	Wooden containers	2.509
2411	Logging camps and logging contractors	2.472
2421	Sawmills and planing mills, general	2.404
2425	Hardwood dimension and flooring	2.566
2429	Special product sawmills, nec.	2.185
2431	Millwork	2.293
2432	Veneer and plywood	2.436
2433	Prefabricated wood structures	2.260
2491	Wood preserving	2.281
2499	Wood products, nec.	2.224
2500	Paperboard containers and boxes	1.776
2511	Wood household furniture	2.358
2541	Wood partitions and fixtures	2.301
2611	Pulpwoods	2.007
2621	Paper mills, except building paper	2.098
2649	Converted paper products, nec.	2.220
2661	Building paper and board mills	2.143

Appendix Table 3 -- (cont'd.)

GROUPS

Group No.	SIC code	Name	Final demand multiplier
1	24	Wood processing	2.419
2	25	Wood furniture and fixtures	2.359
3	26	Paper mills and products	2.073

Appendix Table 4 -- Sample of import-export information available from Forest Service research stations 1/

Wood Movement for the North Carolina counties of the Chowan-Pasquotank River Basins

	Pulpwood	
	Softwood	Hardwood
	-Cords 2/	
Output	150,943	157,870
Retained	107,268	58,974
Exported	43,675	98,896
Imported	559,930	243,122
Receipts	667,198	302,096

	All other roundwood products	
	Softwood	Hardwood
	MCF 3/	
Output	53,217	21,798
Retained	27,538	14,636
Exported	25,679	7,162
Imported	9,403	21,046
Receipts	36,941	35,682

1/ Source: Southeastern Forest Experiment Station, Asheville, N.C.

2/ 1 cord softwood = 76.68 cu.ft.; 1 cord hardwood = 76.36 cu.ft.

3/ Thousand cubic feet

Appendix Table 5 --- Examples

Example 1: Backward Linkage Effects
$10,000 change in value of output of the Forest Products Sector (#11) exported from the region

ΔTGO = change in total gross output of all industries due to change in demand for exported output of industry j

ΔTE = change in total earnings in the region due to change in demand for exported output of industry j

ΔD_{E_j} = change in demand for exported output of industry j

M_j = regional multiplier for industry j

e_j = factor for converting a change in gross output to a change in earnings

a_{h_j} = household coefficient for industry j, representing sales of households (labor) to industry j

$E.$ = national earnings/gross output ratio
= .3008

Given: $\Delta D_{E_j} = 10{,}000$ From Figure 2: $M_j = 1.556$

$E. = .3008$ $a_{h_j} = .0890$

Change in total gross output: $\Delta TGO = \Delta D_{E_j}(M_j)$

$= 10{,}000(1.556)$

$= 15{,}560$

Change in earnings: Step 1 - $e_j = (1/M_j)(a_{hj}) + (1-1/M_j)(E.)$

$=(1/1.556)(.0890) + (1-1/1.556)(.3008)$

$=.0572 + .1075$

$=.1647$

Step 2 - $\Delta TE = \Delta TGO(e_j)$

$= 15{,}560(.1647)$

$=2562.48$

Example 1 -- (cont'd.)

Change in total employment:

f = regional employment/earnings ratio

ΔTM = change in total employment in the region due to change in demand for the exported output of industry j

Step 1 - $f = \frac{\text{total employment in the region}}{\text{total earnings in the region}}$

$= 520,800/3,744,900,000$

$= .00014$

Step 2 - $\Delta TM = \Delta TE(f)$

$= 2562.48(.00014)$

$= .36$

Example 2 -- Forward linkage effects
$10,000 increase in value of output of the Forest Products sector sold to Logging Camps and Contractors within the region (then exported by logging camps and contractors)

ΔTE = change in total earnings in the region due to change in demand for exported output of industry j

ΔTGO = change in total gross output of all industries due to change in demand for exported output of industry j

ΔD_{E_j} = change in demand for exports of j

M_j = regional multiplier for j

e_j = factor for converting a change in gross output to a change in earnings

a_{h_j} = household coefficient for industry j, representing sales of household (labor) to industry j

a_{ij} = technical coefficient for industry j, representing sales from i to j

X_i = change in output of industry i sold to industry j

E. = national earnings/gross output ratio
= .3008

Given: $X_i = 10,000$ From Figure 3: $M_j = 2.472$

E. = .3008 $a_{hj} = .2198$

$a_{ij} = .3284$

Change in demand for exports of j: $\Delta D_{E_j} = X_i \left(1/a_{ij} \right)$

$= 10,000(1/.3284)$

$= 30,450$

Change in total gross output: $\Delta TGO = \Delta D_{E_j}(M_j)$

$= 30,450(2.472)$

$= 75,274$

Example 2 -- cont'd.)

Change in total earnings Step 1 - $e_j = (1/M_j)(a_{h_j}) + (1 - 1/M_j)(E.)$

$= (1/1.556).2198 + (1 - 1/1.556).3008$

$= .1413 + .1075$

$= .2488$

Step 2 - $\Delta TE = \Delta TGO(e_j)$

$= 75,274(.2488)$

$= \$18,728$

Change in employment:

f = regional employment/earnings ratio

ΔTM = change in total employment in the region due to change in demand for the exported output of industry j

Step 1 - $f = \frac{\text{total employment in the region}}{\text{total earnings in the region}}$

$= 520,800/3,744,900,000$

$= .00014$

Step 2 - $\Delta TM = \Delta TE\ (f)$

$= 18,728\ (.00014)$

$= 2.62$

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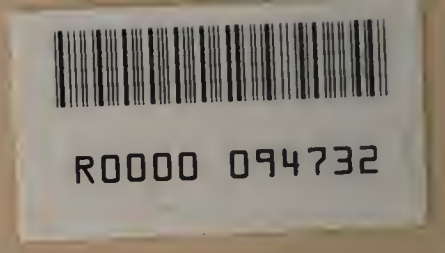
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